HAZARD RANKING SYSTEM (HRS) PACKAGE
WAPPINGER CREEK
DOWNSTREAM OF WAPPINGERS FALLS
WAPPINGER FALLS, NY

EPA ID No.: NYN000201758

EPA Contract No. EP-S13-08-01
TDD No. 0004/1508-06
Document Control No. W0269.1A.00815

April 2016

Prepared for:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Prepared by:
Weston Solutions, Inc.
Edison, New Jersey 08837

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HRS DOCUMENTATION RECORD--REVIEW COVER SHEET

Name of Site: Wappinger Creek

Date Prepared: April 2016

Contact Persons

Site Investigation: Region 2 Site Assessment Team
Weston Solutions, Inc.
Edison, NJ

Documentation Record: Denise Zeno (212) 637-4319
U.S. Environmental Protection Agency
New York, NY

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Pathways, Components, or Threats Not Scored

The surface water migration pathway—drinking water threat, ground water migration pathway, soil exposure pathway, and air migration pathway were not scored because the listing decision is not affected significantly by those pathways. The site score is sufficient to list the site on the surface water migration pathway score based on the human food chain and environmental threats.

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HRS DOCUMENTATION RECORD

Name of Site:	Wappinger Creek	Date Prepared: April 2016
EPA ID No.:	NYN000201758	
EPA Region:	2	
Street Address of Site*:	Wappinger Creek downstream of Wappingers Falls, Wappingers Falls, NY 12590	
County and State:	Dutchess County, New York	
General Location in the State:	Central Hudson River valley	
Topographic Map:	Wappingers Falls, NY	
Latitude*:	41° 35′ 51.6624” North (41.597684°)	Longitude*: 73° 55′ 37.6896″ West (-73.927136°)
Site Reference Point:	U.S. Environmental Protection Agency (EPA) contaminated sediment sample location 0269-SED19	

[**Figures 1 and 2**; Ref. 3, pp. 1, 3; 4, p. 1; 5, p. 2; 33, pp. 92, 97, 102; 54, p. 1; 61, pp. 747, 794, 838]

The site consists of a zone of sediment contamination with no identified source. Therefore, the reference point for the street address and site latitude/longitude coordinates is one of the locations where EPA identified contaminated sediment within the tidal portion of Wappinger Creek (i.e., 0269-SED19) [Ref. 1, p. 51605; 33, pp. 92, 97, 102].

** The street address, coordinates, and contaminant locations presented in this Hazard Ranking System (HRS) documentation record identify the general area where the site is located. They represent one or more locations EPA considers to be part of the site based on the screening information EPA used to evaluate the site for NPL listing. EPA lists national priorities among the known "releases or threatened releases" of hazardous substances; thus, the focus is on the release, not precisely delineated boundaries. A site is defined as where a hazardous substance has been "deposited, stored, placed, or otherwise come to be located." Generally, HRS scoring and the subsequent listing of a release merely represent the initial determination that a certain area may need to be addressed under CERCLA. Accordingly, EPA contemplates that the preliminary description of facility boundaries at the time of scoring will be refined as more information is developed as to where the contamination has come to be located.

Scores

Ground Water Pathway	Not Scored
Surface Water Pathway	100.00
Soil Exposure Pathway	Not Scored
Air Pathway	Not Scored
HRS SITE SCORE	50.00

WORKSHEET FOR COMPUTING HRS SITE SCORE
WAPPINGER CREEK

		S	S^2
1.	Ground Water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	Not Scored	
2a.	Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	100.00	10,000.00
2b.	Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	Not Scored	
2c.	Surface Water Migration Pathway Score (S_{sw}) Enter the larger of lines 2a and 2b as the pathway score.	100.00	10,000.00
3.	Soil Exposure Pathway Score (S_s) (from Table 5-1, line 22)	Not Scored	
4.	Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	Not Scored	
5.	Total of $S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$	10,000.00	
6.	**HRS Site Score** Divide the value on line 5 by 4 and take the square root	50.00	

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET
WAPPINGER CREEK

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT Factor Categories & Factors DRINKING WATER THREAT	MAXIMUM VALUE	VALUE ASSIGNED
Likelihood of Release		
1. Observed Release	550	550
2. Potential to Release by Overland Flow		
2a. Containment	10	not scored
2b. Runoff	25	not scored
2c. Distance to Surface Water	25	not scored
2d. Potential to Release by Overland Flow (lines 2a [2b + 2c])	500	not scored
3. Potential to Release by Flood		
3a. Containment (Flood)	10	not scored
3b. Flood Frequency	50	not scored
3c. Potential to Release by Flood (lines 3a x 3b)	500	not scored
4. Potential to Release (lines 2d + 3c)	500	not scored
5. Likelihood of Release (higher of lines 1 and 4)	550	550
Waste Characteristics		
6. Toxicity/Persistence	*	not scored
7. Hazardous Waste Quantity	*	not scored
8. Waste Characteristics	100	not scored
Targets		
9. Nearest Intake	50	not scored
10. Population		
10a. Level I Concentrations	**	not scored
10b. Level II Concentrations	**	not scored
10c. Potential Contamination	**	not scored
10d. Population (lines 10a + 10b + 10c)	**	not scored
11. Resources	5	not scored
12. Targets (lines 9 + 10d + 11)	**	not scored
13. DRINKING WATER THREAT SCORE ([lines 5 x 8 x 12]/82,500)	100	not scored

* Maximum value applies to waste characteristics category.
** Maximum value not applicable

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET
WAPPINGER CREEK

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT Factor Categories & Factors HUMAN FOOD CHAIN THREAT	MAXIMUM VALUE	VALUE ASSIGNED
Likelihood of Release		
14. Likelihood of Release (same as line 5)	550	550
Waste Characteristics		
15. Toxicity/Persistence/Bioaccumulation	*	5.00E+08
16. Hazardous Waste Quantity	*	100
17. Waste Characteristics	1,000	320
Targets		
18. Food Chain Individual	50	45
19. Population		
19a. Level I Concentrations	**	0
19b. Level II Concentrations	**	0.03
19c. Potential Human Food Chain Contamination	**	0
19d. Population (lines 19a + 19b + 19c)	**	0.03
20. Targets (lines 18 + 19d)	**	45.03
21. HUMAN FOOD CHAIN THREAT SCORE ([lines 14 x 17 x 20]/82,500)	100	96

* Maximum value applies to waste characteristics category.
** Maximum value not applicable

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET
WAPPINGER CREEK

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT Factor Categories & Factors ENVIRONMENTAL THREAT	MAXIMUM VALUE	VALUE ASSIGNED
Likelihood of Release		
22. Likelihood of Release (same as line 5)	550	550
Waste Characteristics		
23. Ecosystem Toxicity/Persistence/Bioaccumulation	*	5.00E+08
24. Hazardous Waste Quantity	*	100
25. Waste Characteristics	1,000	320
Targets		
26. Sensitive Environments		
26a. Level I Concentrations	**	0
26b. Level II Concentrations	**	25
26c. Potential Contamination	**	0
26d. Sensitive Environments (lines 26a + 26b + 26c)	**	25
27. Targets (line 26d)	**	25
28. ENVIRONMENTAL THREAT SCORE ([lines 22 x 25 x 27]/82,500)	60	53.33
29. WATERSHED SCORE (lines 13 + 21 + 28)	100	100
30. SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE (S_{of})	100	100
SURFACE WATER MIGRATION PATHWAY SCORE (S_{sw})	100	100

* Maximum value applies to waste characteristics category.
** Maximum value not applicable

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19.	Arnone, Russell, USEPA/R2/HWSB/HWSS. Executive Narrative for Case No. 45717, SDG No. BC761, Wappinger Creek; with attached analytical data. November 17, 2015. [75 pages]
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28.	Kumar, Narendra, USEPA/R2/HWSB/HWSS. Executive Narrative for Case No. 45717, SDG No. MBC7E7, Wappinger Creek; with attached analytical data. December 1, 2015. [34 pages]
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SITE DESCRIPTION

The Wappinger Creek site in Wappingers Falls, New York, is the location of contaminated sediments with no identified source of the release causing the contamination. Sediment sampling and analysis by the U.S. Environmental Protection Agency (EPA) in November 2015 document the presence of mercury and benzo(a)pyrene in the tidal portion of Wappinger Creek at concentrations that meet the criteria for observed release by chemical analysis [see **Section 4.1.2.1** of this Hazard Ranking System (HRS) documentation record]. The November 2015 sediment sample results document Level II actual contamination of a fishery and a wetland [see **Sections 4.1.3.3 and 4.1.4.3** of this HRS documentation record]. A Site Location Map is presented in Figure 1. The zone of sediment contamination is depicted on Figure 2.

For the Wappinger Creek site, EPA is evaluating the human food chain and environmental threats of the surface water migration pathway, overland/flood migration component. The source is evaluated as sediment contaminated with mercury and benzo(a)pyrene with no identified source (Source 1) because of the presence of several current and historical possible sources of mercury and benzo(a)pyrene in the vicinity of the site that may have contributed to the contamination, as further discussed in **Section 4.1.2.1.1** of this HRS documentation record.

The tidal portion of Wappinger Creek begins downstream of Wappingers Falls, by an industrial park and extends for approximately 2 miles downstream to the confluence with the Hudson River [Ref. 6, p. 68]. Water levels in the creek can typically fluctuate as much as 4 feet during the tidal cycle of the Hudson River [Ref. 6, p. 68]. At the upstream end, the tidal creek is approximately 90 feet wide; retaining walls border both sides of the creek in this reach [Ref. 6, p. 69]. Downstream, the creek width expands to approximately 600–800 feet [Ref. 6, p. 70]. The width is constricted to approximately 140 feet and 250 feet wide by the County Route 28 (CR 28) bridge and a railroad bridge, respectively, as the creek approaches the Hudson River [Ref. 6, p. 70]. Water depths in the creek range from less than 5 feet to approximately 25 feet, with the greatest depth beneath the CR 28 bridge [Ref. 6, p. 70]. The composition of the creek bed varies from rocks and cobbles in the fast-moving reach near the industrial park at the most upstream part of the tidal portion of the creek to silt in low-flow areas [Ref. 6, pp. 69–70].

The previously identified industrial park is located approximately 0.2 miles downstream of the falls separating Wappinger Lake from Wappinger Creek. The industrial park is located on both the north and south banks of Wappinger Creek, with two bridges connecting the banks. Industrial activities have occurred at the industrial park location for more than 180 years [Ref. 9, p. 3].

The contaminated sediment portion of the creek is a human food chain fishery and contains wetland area, including a shallow embayment located along the west-northwestern shore of Wappinger Creek approximately 0.75 mile downstream of an industrial park situated at the upstream end of the tidal creek [**Figure 2**; Ref. 6, p. 69]. This embayment is approximately 240,000 square feet (ft^2) (approximately 800 feet by 300 feet) and is fronted by Palustrine Freshwater Forested/Shrub Wetland (PFO1S) [Ref. 24, p. 1]. Sediment in this embayment is primarily of silt and organic matter and supports aquatic emergent and submerged plant growth throughout [Ref. 6, pp. 9, 70]. The main currents of the tidal creek bypass the embayment, which experiences minimal water velocity and can generally be described as quiescent [Ref. 6, pp. 9, 70]. During New York State Department of Environmental Conservation's (NYSDEC) sampling efforts associated with a remedial investigation (RI) at the industrial park sediment contamination was documented in the embayment and throughout the tidal creek, with some of the highest concentrations reported for the embayment [Ref. 6, pp. 31–32]. The Wappinger Greenway, which includes the Wappinger Greenway Trail, runs along the west-northwestern bank of Wappinger Creek and includes the embayment [Ref. 14, p. 2]. The Wappinger Greenway Trail links historical, cultural, natural, and economic resources of local and regional significance [Ref. 14, p. 2].

Historical Sediment Sampling

Sediment contamination was identified by RIs conducted at Wappinger Creek and the industrial park located at the upstream end of the tidal portion of the Wappinger Creek by NYSDEC. NYSDEC collected surface water and sediment samples from this tidally-influenced creek and from Wappinger Lake upstream in 2001, 2002, 2003, and 2009 [Ref. 6, pp. 18–52, 74–76, 188–241]. The analytical results for the samples indicated that creek sediments adjacent to and downstream of the industrial park are contaminated with several inorganic constituents, including mercury, lead, and chromium, as well as polycyclic aromatic hydrocarbons (PAH), at concentrations above those

detected in upstream samples [Ref. 6, pp. 31–32, 254, 256, 258, 260, 262, 276–282, 728–729, 731–735, 740–742, 817–828, 834–838].

SOURCE:
U.S. Geologic Survey (USGS). 7.5 Minute Series (Topographic) Quadrangles: Wappingers Falls, NY, NY 1981.

TITLE:
Site Location Map
Wappinger Creek
Village of Wappingers Falls, NY

PROJECT:
Wappinger Creek

CLIENT NAME:
EPA

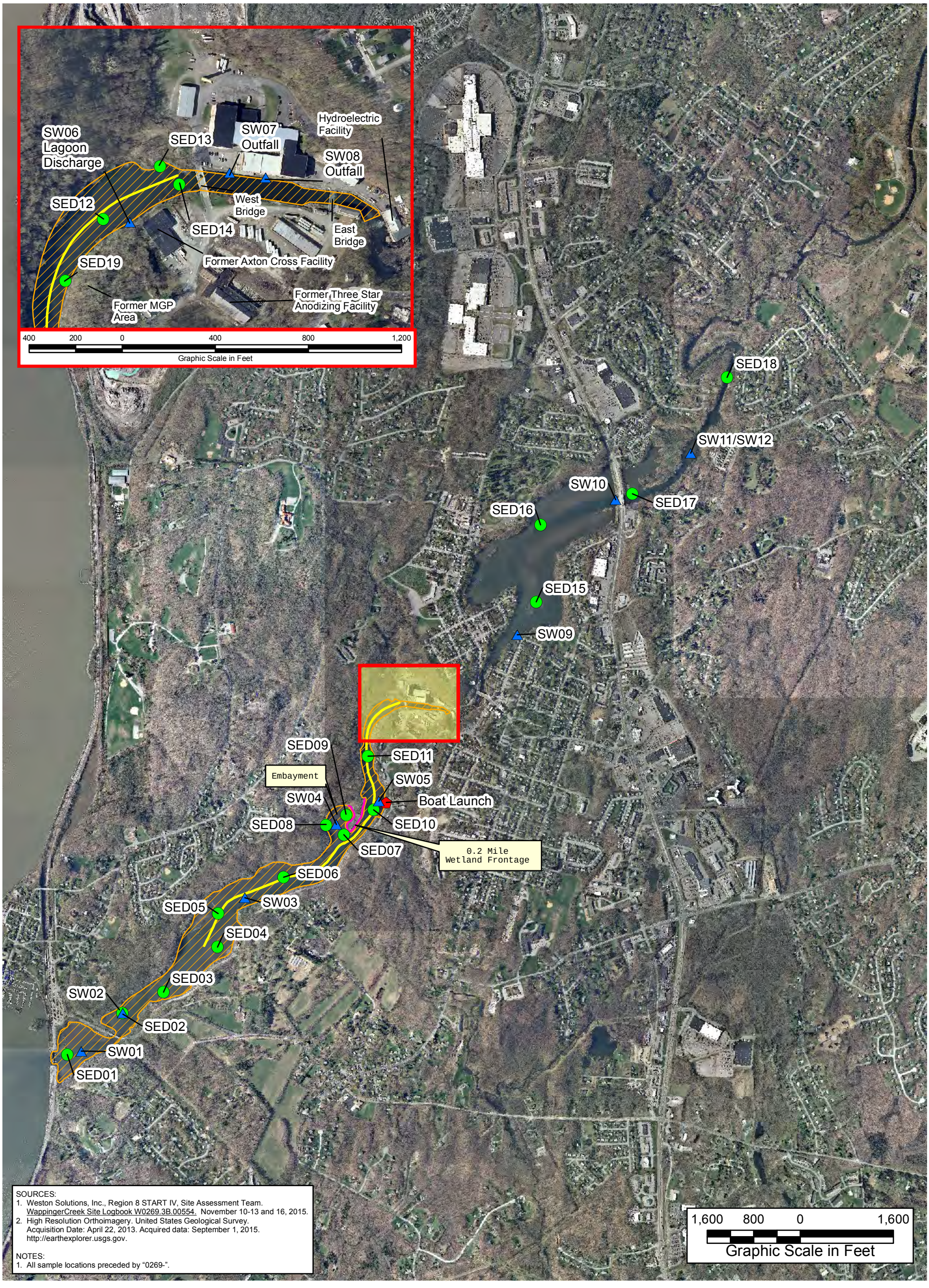
WESTON SOLUTIONS

DATE:
April 2016

FIGURE #:
1

P:\SAT2\Wappinger Creek\MXD\16820_WC_Topo.mxd

P:\SAT2\Wappinger Creek\MXD\17484_WC_Surface_Water_Pathway_Zone_of_Cont_R1.mxd



SOURCES:
1. Weston Solutions, Inc., Region 8 START IV, Site Assessment Team. WappingerCreek Site Logbook W0269.3B.00554. November 10-13 and 16, 2015.
2. High Resolution Orthoimagery. United States Geological Survey. Acquisition Date: April 22, 2013. Acquired data: September 1, 2015. http://earthexplorer.usgs.gov.

NOTES:
1. All sample locations preceded by "0269-".

LEGEND:
- Sediment Coring Location
- Surface Water Sample Location
- Site Feature
- Zone of Contamination
- Wetland Frontage
- Fishery

PROJECT: Wappinger Creek

CLIENT NAME: EPA

Surface Water Pathway Zone of Contamination Wappinger Creek

DRAWING NUMBER: 17484

FIGURE #: 2

DRAWN BY: P. DiTillio

REVIEWED BY: S. Snyder

PROJECT MANAGER: S. Snyder

SCALE: 1 " = 1,600 '

DATE: April 2016

N W E S

EPA Sediment Sampling

From November 10 through 13 and on November 16, 2015, EPA collected surface water and sediment samples from Wappinger Creek [**Figure 2**; Ref. 17, pp. 14–37, 45–70; 25, pp. 1–6, 8–13, 30–64]. Samples were collected from the tidal portion of Wappinger Creek adjacent to and downstream of the industrial park [**Figure 2**; Ref. 17, pp. 15–25, 30–31, 45–61; 25, pp. 4, 8–11]. Upstream samples were collected above Wappingers Falls from Wappinger Lake and from Wappinger Creek upstream of the lake [**Figure 2**; Ref. 17, pp. 29, 61–68; 25, pp. 5, 9, 11–12, 57–60]. The sediment samples in the tidal portion of the creek were collected from similar locations as those identified by NYSDEC in 2001/2003 [**Figure 2**; Ref. 6, p. 32]. The sediment sampling and analysis by EPA documents an observed release by chemical analysis along the surface water migration pathway adjacent to and downstream of the industrial park [See **Section 4.1.2.1**].

Sediment sample analytical results report the presence of mercury and benzo(a)pyrene at concentrations significantly above background concentrations in the tidal portion of Wappinger Creek, delineating a zone of contamination that extends from the industrial park to approximately 0.25 mile upstream of the CR 28 Bridge [**Figure 2**; see **Section 4.1.2.1**]. With the exception of an estimated concentration of cis-1,2-dicholoroethene (DCE) detected in a surface water sample collected at the mouth of the former Three Star lagoon (0269-SW06) at the industrial park, analytical results for the surface water samples collected adjacent to and downstream of the industrial park reported non-detect values for organic contaminants of concern [Ref. 17, p. 16; 31, pp. 27–68]. Detections of inorganic constituents in surface water were comparable to upstream concentrations [Ref. 45, pp. 15–16, 23–37, 41–46].

Six (including one environmental duplicate sample) of the sediment samples were also analyzed for dioxins and furans by a non-EPA laboratory [Ref. 17, p. 31; 25, pp. 3, 5, 49–50, 55; 39, pp. 5, 11, 17; 40, pp. 5, 10, 24]. Results for two (0269-SED12-12-24 and 0269-SED14-6-12) of the sediment samples collected adjacent to the industrial park at depths of 6–12 and 12–24 inches report 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) equivalent (hereafter referred to as "dioxin") concentrations that exceed the NYSDEC fresh water sediment guidance value (SGV) for dioxin [Ref. 25, p. 19; 46, pp. 1–6, 9–10, 12]. Dioxin is produced by a number of processes, including the burning of coal and chlorine bleaching, both of which are known to have been conducted at the industrial park [Ref. 7, p. 15; 9, p. 25; 47, p.3].

Six (including one environmental duplicate sample) of the sediment samples were also analyzed for methyl mercury by a non-EPA laboratory [Ref. 25, pp. 2, 46]. The reported methyl mercury concentrations ranged from non-detect to 1.3 micrograms per kilogram (µg/kg) [Ref. 34, pp. 3, 5].

The segment of Wappinger Creek under consideration (i.e., the tidal portion of the creek) is utilized for fishing for human consumption and secondary contact recreation [**Figure 2**; Ref. 3, pp. 6, 12; 16, pp. 2–3; 17, p. 20]. Walking trails and public spaces provide access to the shoreline [Ref. 14, p. 2]. The embayment includes wetland frontage of 0.2 mile that fronts the zone of contamination [**Figure 2**; Ref. 24, p. 1].

SOURCE DESCRIPTION

2.2 SOURCE CHARACTERIZATION

2.2.1 Source Identification

Number of the source: Source No. 1

Name and description of the source: Wappinger Creek contaminated sediments

Source Type: Other–contaminated sediments with no identified source

Source 1 consists of contaminated sediments in the tidal portion of Wappinger Creek. Sediment samples collected by EPA in November 2015, document that hazardous substances (i.e., mercury and benzo[a]pyrene) are present in sediment at levels that meet the criteria for observed release by chemical analysis [Ref. 1, Section 4.1.2.1.1]. From November 10 through 13 and on November 16, 2015, EPA collected surface water and sediment samples from Wappinger Creek [**Figure 2**; Ref. 17, pp. 14–37, 45–70; 25, pp. 1–6, 8–13, 30–64]. Samples were collected from throughout the tidal portion of the creek, from the industrial park to just upstream of the confluence with the Hudson River [**Figure 2**; Ref. 17, pp. 15–25, 30–31, 45–61; 25, pp. 4, 8–11]. Upstream samples were collected above Wappingers Falls from Wappinger Lake and from Wappinger Creek upstream of the lake [**Figure 2**; Ref. 17, pp. 29, 61–68; 25, pp. 5, 9, 11–12; 57–60]. The Wappinger Creek samples in the tidal portion of the creek were collected in an upstream, or northerly, direction starting downstream of the CR 28 bridge near the confluence with the Hudson River to the bulk-headed portion of the creek between the northern and southern portions of the industrial park [**Figure 2**; Ref. 17, pp. 15–25, 30–31, 48–49; 25, pp. 8–11]. The sediment samples were collected from similar locations to those sampled by NYSDEC in 2001/2003 [**Figure 2**; Ref. 6, p. 32]. Sediment samples from above Wappingers Falls were also collected in an upstream direction, starting at the southern end of Wappinger Lake to the samples in Wappinger Creek upstream of the lake [**Figure 2**; Ref. 17, pp. 29, 32–34]. All of the sediment samples were collected from a boat using Vibracore push coring technology [Ref. 17, pp. 18–25, 49–57, 59, 63–66; 25, p .5]. With one exception due to low recovery or refusal, the sediment samples were collected from depth intervals of 0–6, 6–12, and 12–24 inches [Ref. 17, pp. 19–21, 24–25, 31, 36, 54, 64–65; 25, pp. 5, 9–12].

The industrial park is located approximately 0.2 miles downstream of the falls separating Wappinger Lake from Wappinger Creek. The industrial park is located on both the north and south banks of Wappinger Creek, with two bridges connecting the banks. Industrial activities have occurred at the industrial park location for more than 180 years [Ref. 9, p. 3].

The surface water and sediment samples collected by EPA were analyzed under the EPA Contract Laboratory Program (CLP) for Organic Target Analyte List (TAL) volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs), and Inorganic TAL parameters (including mercury) [Ref. 11, p. 3; 17, pp. 18, 21, 25, 31, 35; 25, pp. 1–3, 6, 30–38, 41–45 51–52, 56–60, 65–72, 75–76, 79–80; 55, p. 1; 56, p. 1; 58, p. 1; 60, p. 1; 61, p. 1; 62, p .3; 64, p. 3; 65, p. 3; 66, p. 3]. All of the sediment samples were also analyzed by non-CLP laboratories for total organic carbon (TOC) and grain size distribution [Ref. 17, pp. 25, 31, 35–36; 25, pp. 1–3, 5, 39–40, 47–50, 53–55, 61–64, 74, 77–78, 81–82; 35, p. 4; 36, p. 4; 37, p. 4; 38, pp. 5–22; 39, pp. 3–4, 8–10, 14–16, 20–22; 40, pp. 3–4; 8, 13–23, 35; 41, pp. 3–19].

The sediment sampling and analysis by EPA documents an observed release by chemical analysis along the surface water migration pathway [see **Section 4.1.2.1** of this HRS documentation record]. CLP analytical results report the presence of mercury and benzo(a)pyrene at concentrations significantly above background in the tidal creek main channel [See **Section 4.1.2.1** of this HRS documentation record] The zone of actual contamination extends from EPA sediment sampling location 0269-SED14 to EPA sediment sampling location 0269-SED04, a distance of approximately 1.2 miles (6,082 feet) downstream, and includes sediment samples 0269-SED14-0-6, 0269-SED19-0-6, 0269-SED19-6-12, 0269-SED19-12-24, 0269-SED07-0-6, 0269-SED06-0-6, and 0269-SED04-6-12 [**Figure 2**]. See **Section 4.1.2.1** of this HRS documentation record for information needed to establish that these sediment samples meet observed release criteria.

Because they are located in a similar tidal environment, and can be used to characterize contaminant contributions from the Hudson River, EPA sediment sampling locations 0269-SED01 and 0269-SED02 are evaluated as representing background conditions in the Wappinger Creek main channel [**Figure 2**; Ref.1, Section 4.1.2.1.1].

As further discussed in **Section 4.1.2.1** of this HRS documentation record, due to the length of time multiple varying industrial activities have been conducted along the upstream end of the tidal portion of Wappinger Creek at the industrial park, the presence of a various industrial and commercial activities upstream, and the discharge of village storm water to Wappinger Creek, the number of possible sources of the sediment contamination is too numerous to specifically determine which have caused a significant increase in the contamination documented in the observed release.

Location of the source, with reference to a map of the site:

Wappinger Creek sediment contamination extends from EPA sediment sampling location 0269-SED14 to 0269-SED04, a distance of approximately 1.2 miles [see **Section 4.1.2.1**]. The zone of contamination is depicted on **Figure 2**.

Containment

Release to surface water via overland migration and/or flood:

The presence of mercury and benzo(a)pyrene provides evidence that hazardous substances have migrated to Wappinger Creek [see **Section 4.1.2.1** of this HRS documentation record]. During the November 2015 sediment sampling, neither of the following were observed or encountered while advancing the Vibracore: (1) maintained engineered cover, or (2) functioning and maintained run-on control system and runoff management system [Ref. 1, Table 4-2; 17, pp. 18–25, 29–30, 50–51, 53–55, 57]. Based on the documented migration of contamination (i.e., mercury and benzo[a]pyrene) in Wappinger Creek sediments and the lack of containment features preventing further migration of the contamination, a surface water containment factor value for overland migration of 10 is assigned for this source [Ref.1, Table 4-2].

2.2.2 Hazardous Substances

Sampling and analysis by EPA in November 2015 show the presence of mercury and benzo(a)pyrene in Wappinger Creek sediments at concentrations significantly above background concentrations [See **Section 4.1.2.1** of this HRS documentation record]. A zone of actual contamination extends from EPA sediment sampling location 0269-SED14 to 0269-SED04, a distance of approximately 1.2 miles [**Figure 2**]. Mercury and benzo(a)pyrene were detected at maximum concentrations of 16.7 mg/kg (0269-SED04-6-12) and 2,100 µg/kg (0269-SED14-0-6 and 0269-SED19-6-12), respectively [Ref. 33, p. 102; 42, p. 32; 48, p. 39; 55, p. 538; 61, p. 838; 64, p. 598]. Refer to Section **4.1.2.1** of this HRS documentation record for information supporting the significant increase above background levels of these substances.

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Tier A – Hazardous Constituent Quantity

The hazardous constituent quantity for Source 1 could not be adequately determined according to the HRS requirements; that is, the total mass of all Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances in the source and releases from the source is not known and cannot be estimated with reasonable confidence [Ref. 1, Section 2.4.2.1.1]. There are insufficient historical and current data [manifests, potentially responsible party (PRP) records, State records, permits, waste concentration data, etc.] available to adequately calculate the total or partial mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source 1 with reasonable confidence. As a result, the evaluation of hazardous waste quantity proceeds to the evaluation of *Tier B*, Hazardous Wastestream Quantity [Ref 1, Section 2.4.2.1.1].

Hazardous Constituent Quantity (C) Value: NS

2.4.2.1.2 Tier B – Hazardous Wastestream Quantity

The hazardous wastestream quantity for Source 1 could not be adequately determined according to the HRS requirements; that is, the total mass of all hazardous wastestreams plus the mass of any additional CERCLA pollutants and contaminants in the source and releases from the source is not known and cannot be estimated with reasonable confidence [Ref. 1, Section 2.4.2.1.2]. There are insufficient historical and current data (manifests, PRP records, State records, permits, waste concentration data, etc.) available to adequately calculate the total mass or partial mass of the hazardous wastestreams plus the mass of all CERCLA pollutants and contaminants in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous wastestream quantity for Source 1 with reasonable confidence. Scoring proceeds to the evaluation of *Tier C*, Volume [Ref. 1, Section 2.4.2.1.2].

Hazardous Wastestream Quantity (W) Value: NS

2.4.2.1.3 Tier C – Volume

A zone of contamination has been identified that extends from EPA sediment sampling location 0269-SED14 to 0269-SED04, a distance of approximately 1.2 miles (6,082 feet) downstream; however, significant detections of mercury and benzo(a)pyrene are not continuous throughout the zone [see **Section 4.1.2.1** of this HRS documentation record]. Therefore, the total volume of contaminated sediment is unknown and is considered to be greater than 0 (>0) cubic yards (yd^3). The source type is "Other," so the volume value is divided by 2.5 to obtain the assigned value shown below [Ref. 1, Section 2.4.2.1.3].

Dimension of source (yd^3): >0 yd^3
Volume (V) Assigned Value: >0/2.5 = >0

2.4.2.1.4 Tier D – Area

The Tier D is not evaluated for source type "Other" [Ref. 1, Section 2.4.2.1.4].

Area (A) Assigned Value: 0

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source hazardous waste quantity value for Source 1 is >0 for Tier C – Volume [Ref. 1, Section 2.4.2, 2.4.2.1.4].

Source Hazardous Waste Quantity Value: >0

SITE SUMMARY OF SOURCE DESCRIPTIONS

TABLE 1. HAZARDOUS WASTE QUANTITY AND CONTAINMENT					
Source Number	Source Hazardous Waste Quantity Value	Containment			
		Ground Water	Surface Water	Air	
				Gas	Particulate
1	>0	NS	10	NS	NS

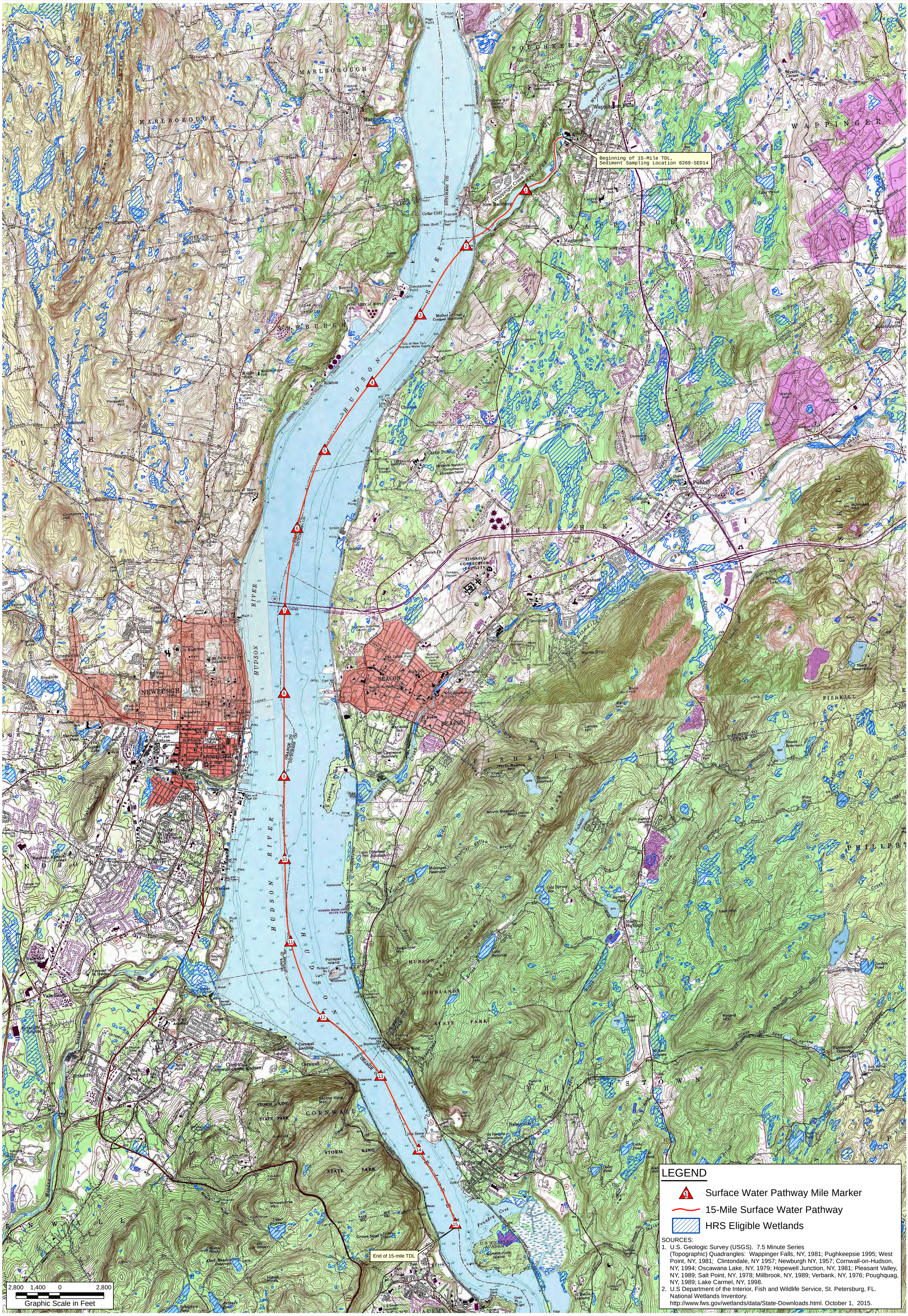
NS = Not Scored

4.1 OVERLAND/FLOOD MIGRATION COMPONENT

4.1.1.1 Definition of Hazardous Substance Migration Path for Overland/Flood Component

The tidal portion of Wappinger Creek begins downstream of Wappingers Falls, upstream of the industrial park, and extends for approximately 2 miles downstream to the confluence with the Hudson River [**Figures 2 and 3**; Ref. 6, p. 68]. Water levels in the creek can typically fluctuate as much as 4 feet during the tidal cycle of the Hudson River [Ref. 6, p. 68]. In the vicinity of the industrial park, the creek is approximately 90 feet wide; retaining walls border both sides of the creek in this reach [Ref. 6, p. 69; 17, pp. 48–49]. Downstream, the creek width expands to approximately 800 feet [Ref. 6, p. 70]. The width is constricted to approximately 140 feet and 250 feet wide by the CR 28 bridge and a railroad bridge, respectively, as the creek approaches the Hudson River [Ref. 6, p. 70]. Water depths in the creek range from less than 5 feet to approximately 25 feet, with the greatest depth beneath the CR 28 bridge [Ref. 6, p. 70]. The composition of the creek bed varies from rocks and cobbles in the fast-moving reach near the industrial park to silt and organic matter in low-flow areas [Ref. 6, p. 69–70].

A shallow embayment is located along the northern shore of Wappinger Creek approximately 0.75 mile downstream of the industrial park [**Figure 2**; Ref. 6, p. 69]. This embayment is approximately 240,000 ft^2 (approximately 800 feet by 300 feet) and is fronted by Palustrine Freshwater Forested/Shrub Wetland (PFO1S) [Ref. 24, p. 1]. Sediment in this embayment is primarily of silt and organic matter and supports aquatic emergent and submerged plant growth throughout [Ref. 6, pp. 9, 70]. The main currents of the tidal portion of the creek bypass the embayment, which experiences minimal water velocity and can generally be described as quiescent [Ref. 6, p. 70]. The Wappinger Greenway, which includes the Wappinger Greenway Trail, runs along the west-northwestern bank of Wappinger Creek from just downstream of the industrial park to the CR 28 bridge, and includes the embayment [Ref. 14, p. 2]. The Wappinger Greenway Trail links historical, cultural, natural, and economic resources of local and regional significance and provides access to the shoreline [Ref. 14, p. 2]. The source under evaluation for the site is contaminated sediments with no identified source [Ref. 1, Section 4.1.1.1]. The in-water segment of the 15-mile target distance limit (TDL) for the surface water pathway begins at the upstream boundary of the zone of contamination (i.e., EPA sediment sampling location 0269-SED14) [**Figures 2 and 3;** Ref. 1, Section 4.1.1.2]. The surface water migration pathway for the Wappinger Creek site extends for approximately 2 miles along the tidal creek to the Hudson River [**Figure 3**]. The 15-mile TDL terminates in the Hudson River to at least 13 miles south and downstream of Wappinger Creek, but contamination may also extend upstream in the Hudson River due to tidal carry [**Figure 3**].



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N W E S

REPORT DATE: April 2016	PROJECT MANAGER: S. Synder	CLIENT NAME: EPA	DRAWING TITLE: 15-Mile Surface Water Pathway Map Wappinger Creek
DRAWING: 17483_WappingerCreek_15_Mile_Pathway_R1.mxd PATH: P:\SAT2\Wappinger Creek\MXD\	CHECKED BY: S. Synder		
REVISION No.: 1	CONTRACT No.: EP-S13-08-01	PROJECT NAME: Wappinger Creek	
WORK ORDER No.: 20408.012.004.0269.00	DRAWN/MODIFIED BY: J. Heaton DATE CREATED: 11/23/2015		FIGURE: 3 SCALE: 1 " = 2,800 ' DATE: 3/14/2016

4.1.2.1 Likelihood of Release

4.1.2.1.1 Observed Release

An observed release to surface water is documented by chemical analysis.

Chemical Analysis

Sediment samples collected by EPA adjacent to and downstream of the industrial park in November 2015, document that hazardous substances (i.e., mercury and benzo[a]pyrene) are present in sediment at levels that meet the criteria for observed release by chemical analysis [Ref. 1, Section 4.1.2.1.1]. From November 10 through 13 and on November 16, 2015, EPA collected surface water and sediment samples from Wappinger Creek [**Figure 2**; Ref. 17, pp. 14–37, 45–70; 25, pp. 1–6, 8–13, 30–64]. Samples were collected from throughout the tidal portion of Wappinger Creek, from the industrial park to just upstream of the confluence with the Hudson River [**Figure 2**; Ref. 17, pp. 15–25, 30–31, 45–61; 24; 25, pp. 8–11]. Upstream samples were collected above Wappingers Falls from Wappinger Lake and from Wappinger Creek upstream of the lake [**Figure 2**; Ref. 17, pp. 29, 32–37, 61–68; 25, pp. 9, 11–12]. The Wappinger Creek samples were collected in an upstream, or northerly, direction starting downstream of the CR 28 bridge near the confluence with the Hudson River to just downstream of the bulk-headed portion of the creek between the northern and southern portions of the industrial park [**Figure 2**; Ref. 17, pp. 15–25, 30–31, 48–49; 25, pp. 8–11]. The sediment samples were collected from similar locations as those identified by NYSDEC in 2001/2003 [**Figure 2**; Ref. 6, p. 32]. Sediment samples upstream of Wappingers Falls were also collected in an upstream direction, starting at the southern end of Wappinger Lake to the samples in Wappinger Creek upstream of the lake [**Figure 2**; Ref. 17, pp. 29, 32–34]. All of the sediment samples were collected from a boat using Vibracore push coring technology [Ref. 17, pp. 18–25, 49–57, 59, 63–66; 25, p. 5]. With one exception due to low recovery or refusal, the sediment samples were collected from depth intervals of 0–6, 6–12, and 12–24 inches [Ref. 17, pp. 19–21, 24–25, 31, 36, 54, 64–65; 25, pp. 5, 9–12].

The surface water and sediment samples collected by EPA were analyzed under the EPA CLP for Organic TAL VOCs and SVOCs, and Inorganic TAL parameters (including mercury) [Ref. 11, p. 3; 17, pp. 18, 21, 25, 31, 35; 25, pp. 1–3, 6, 30–38, 41–45 51–52, 56–60, 65–72, 75–76, 79–80; 55, p. 1; 56, p. 1; 58, p. 1; 60, p. 1; 61, p. 1; 62, p .3; 64, p. 3; 65, p. 3; 66, p. 3]. All of the sediment samples were also analyzed by non-CLP laboratories for total organic carbon (TOC) and grain size distribution [Ref. 17, pp. 25, 31, 35–36; 25, pp. 1–3, 5, 39–40, 47–50, 53–55, 61–64, 74, 77–78, 81–82; 35, p. 4; 36, p. 4; 37, p. 4; 38, pp. 5–22; 39, pp. 3–4, 8–10, 14–16, 20–22; 40, pp. 3–4; 8, 13–23, 35; 41, pp. 3–19].

The sediment sampling and analysis by EPA documents an observed release of mercury and benzo(a)pyrene by chemical analysis along the surface water migration pathway downstream from the industrial park to approximately 0.25 upstream of the CR 28 bridge [**Figure 2**; **Tables 3 and 5**]. The zone of contamination extends from EPA sediment sampling location 0269-SED14, adjacent to the west bridge of the industrial park to EPA sediment sampling location 0269-SED04, approximately 1.2 miles (6,082 feet) downstream [**Figure 2**].

Because they are located in a similar tidal environment as the observed release samples, and can be used to characterize contaminant contributions from the Hudson River, EPA sediment sampling locations 0269-SED01 and 0269-SED02 are evaluated as representing background conditions in the Wappinger Creek main channel [**Figure 2**; 6, p. 68]. Six background sediment samples (and one duplicate sample) were collected from two locations (0269-SED-01 and 0269-SED02). 0269-SED01 was located near the confluence with the Hudson River, and 0269-SED02 was located just upstream of the CR 28 Bridge [**Figure 2**]. Samples were collected from depth intervals of 0-6 inches, 6-12 inches, and 12-24 inches at both locations.

Mercury concentrations of the background samples ranged from below analytical detection levels in sediment sample 0269-SED01-12-24 (depth: 12–24 inches) to 0.57 J- (the result is an estimated quantity, but the result may be biased low) mg/kg in sediment sample 0269-SED01-0-6 (depth: 0–6 inches) [**Figure 2**; Ref. 25, p. 33; 48, pp. 2, 10, 18; 64, p. 587–588]. Because the reported result for 0269-SED01-0-6 of 0.57 (J-) represents the maximum background concentration, and is

used in the observed release evaluation to account for the possible low bias in the 0.57(J-) sample result, EPA projected the possible impact of this the value was adjusted per EPA Quick Reference Fact Sheet *Using Qualified Data to Document an Observed Release and Observed Contamination*; the adjusted result is 1.04 mg/kg (0.57 x 1.83) [Ref. 51, pp. 5–8, 18]. Percent (%) solids in the background samples designated for inorganic analysis ranged from 49.4% in sediment sample 0269-SED22-0-6 (environmental duplicate of 0269-SED02-0-6) to 72.8% in sediment sample 0269-SED01-12-24 [**Figure 2**; Ref. 25, p. 35; 48, pp. 18, 54]. The HRS significant increase criteria were verified in consideration of this projected adjustment.

Benzo(a)pyrene concentrations were below analytical detection levels with the detection limit range of 200-290 µg/kg in all of the background samples [**Figure 2**; Ref. 25, p. 35; 32, pp. 2, 24, 29; 60, pp. 576, 591]. Percent solids in the background samples designated for organic analyses ranged from 50.4% in sediment sample 0269-SED22-0-6 to 71.5% in sediment sample 0269-SED01-6-12 [**Figure 2**; Ref. 25, p. 35; 32, pp. 23, 106]. Total organic carbon (TOC) concentrations in the background sediment samples ranged from 19,000 mg/kg in sediment sample 0269-SED01-12-24 to 34,600 mg/kg in sediment sample 0269-SED02-0-6 [**Figure 2**; Ref. 25, p. 47; 36, p. 5]. Percent total fines (silt and clay) in the background samples ranged from 27.5% in sediment sample 0269-SED01-6-12 to 86.5% in sediment sample 0269-SED02-6-12 [**Figure 2**; Ref. 25, p. 39; 38, pp. 7, 10; 49, p. 1].

Sampling and analysis by EPA in November 2015 show the presence of mercury and benzo(a)pyrene at concentrations significantly above background at two and seven sample locations, respectively. Tables 2 and 4 show the physical characteristics of the samples that document maximum background, and observed release concentrations; Tables 3 and 5 present the mercury and benzo(a)pyrene results that meet observed release criteria. In order to show that the increase in contaminant (i.e., mercury and benzo[a]pyrene) concentrations are not due to any of the differences between background and release sediment sample characteristics, release concentrations are compared to the maximum reported background concentration in the observed release evaluation, as opposed to comparing them to the maximum concentration in the corresponding depth intervals of the background samples.

Background and Observed Release Sample Physical Characteristics
EPA Background and Release Sediment Samples, November 2015

TABLE 2. BACKGROUND AND RELEASE SAMPLE INFORMATION–MERCURY										
Field Sample ID	**Inorganic CLP No.**	**Sample Date**	**Sample Time**	**Height of Water Column (ft)**	**Depth below top of sediment (in)**	**Solids (%)**	**TOC (mg/kg)**	**Total Coarse (%)**	**Total Fines (Silt and Clay) (%)**	**References**
Background Sample										
0269-SED01-0-6	MBC775	11/11/15	1335	16.5	0–6	69.8	19,700	27	69	17, p. 18–19; 25, pp. 35, 39, 47–48; 36, p. 7; 38, p. 5; 48, p. 10; 49, p. 1; 64, p. 587.
Release Samples										
0269-SED04-6-12	MBC786	11/11/15	1630	2	6–12	57.8	25,500	61.2	37	17, p. 20; 25, pp. 34, 39, 47; 36, p. 6; 38, p. 16; 48, p. 39; 49, p. 1; 64, p. 598.
0269-SED06-0-6	MBC790	11/12/15	1000	3.8	0–6	74.9	12,400	88.5	10.5	17, pp. 22–24; 25, pp. 43, 39, 48; 36, p. 6; 38, p. 20; 48, p. 46; 49, p. 1; 64, p. 602.

ft = feet.
in = inches.
TOC = total organic carbon.
mg/kg = milligrams per kilogram.

Background and Observed Release Concentrations
EPA Background and Release Sediment Samples, November 2015

TABLE 3. BACKGROUND AND RELEASE CONCENTRATIONS–MERCURY									
	Maximum Background Concentration					Release Concentrations			
Field Sample ID	0269-SED01-0-6					0269-SED06-0-6		0269-SED04-6-12	
EPA Sample No.	MBC775					MBC790		MBC786	
Sample Date	11/11/15					11/12/15		11/11/15	
Depth (inches)	0–6					0–6		6–12	
	Result	Bias	Adjustment Factor	Adjusted Result	RDL**	Result	RDL**	Result	RDL**
Mercury	0.57 J-*	Low	0.57 x 1.83	1.04	0.15	3.5	0.76	16.7	1.8
References	17, p. 19; 25, p. 33; 48, pp. 2, 6–8, 10, 66; 51, pp. 7–8, 18; 64, p. 587.					17, pp. 22–24; 25, p. 43; 48, pp. 6–8, 46, 66; 64, p. 602.		17, p. 20; 25, p. 34; 48, pp. 6–8, 39, 66; 64, p. 598.	

Mercury concentrations presented in milligrams per kilogram (mg/kg).
RDL = Reporting Detection Limit.
J- = The result is an estimated quantity, but the result may be biased low [Ref. 48, p. 2].
* The "J-" qualified result was adjusted per EPA Quick Reference Fact Sheet *Using Qualified Data to Document and Observed Release and Observed Contamination* [Ref. 51, pp. 5–8, 18].
**The RDL for each result is the contract-required quantitation limit (CRQL) adjusted for sample and method [Ref. 30, p. 8]. Since the samples were analyzed through the CLP, these adjusted CRQLs are used in place of the HRS-defined sample quantitation limit (SQL) [Ref. 1, Sections 1.1 and 2.3].

Notes on samples

- Release sample concentrations are compared to the maximum background concentration.
- Sampling Methods: The background and release samples were all collected from the tidal creek main channel by EPA, using an EPA SOP, during the same sample event in November 2015 [**Figure 2**; Ref. 17, pp. 19–24, 31; 25, pp. 4, 33–34, 43–45, 52; 29, pp. 16, 22–23].
- Analytical Procedures: The background and release samples were all analyzed for Inorganic TAL parameters (including mercury) via EPA CLP Statement of Work (SOW) ISOM02.2 [Analytical Method: Cold Vapor Atomic Absorption (CVAA)] by the same laboratory (Shealy Environmental Services of West Columbia, South Carolina) [Ref. 17, pp. 19–21, 24–25, 31; 25, pp. 1–2, 33–34, 43–45, 52, 70, 72, 76; 64, pp. 3, 587, 598, 602]. The chemical analyses were coordinated through the EPA CLP; EPA validated the data according to EPA Region 2 data validation guidelines [Sample Delivery Group (SDG): MBC775] [Ref. 48, pp. 1–8; 64, p. 3].
- Sample Description: TOC and Grain Size analyses show that background sediment sample contains a similar or greater concentration of TOC and a higher percentage of fine-grained material (i.e., clay and silt) than the release samples [see **Table 2**]. Therefore, the background samples have a similar or greater affinity for contaminants such as mercury [53, p. 6].

Background and Observed Release Sample Physical Characteristics
EPA Background and Release Sediment Samples, November 2015

TABLE 4. BACKGROUND AND RELEASE SAMPLE INFORMATION–BENZO(A)PYRENE										
Field Sample ID	**Organic CLP No.**	**Sample Date**	**Sample Time**	**Height of Water Column (ft)**	**Depth below top of sediment (in)**	**Solids (%)**	**TOC (mg/kg)**	**Total Coarse (%)**	**Total Fines (Silt and Clay) (%)**	**References**
Background Sample										
0269-SED02-0-6	BC778	11/11/15	1500	4.8	0–6	48.9	34,600	11	79	17, p. 20; 25, pp. 35, 39, 47; 32, p. 28; 36, p. 5; 38, p. 8; 49, p. 1; 60, p. 591.
Release Samples										
0269-SED14-0-6	BC7B4	11/13/15	1220	8.2	0–6	83.1	32,800	92	7.5	17, pp. 30–31; 25, pp. 54–56; 35, p. 6; 42, p. 31; 39, p. 15; 49, p. 2; 55, p. 538.
0269-SED19-0-6	BC7C9	11/12/15	1530	10.7	0–6	82.1	16,100	96.5	3	17, pp. 23, 25; 25, pp. 41, 54–55; 33, p. 91; 35, p. 6; 39, p. 20; 49, p. 2; 61, p. 747.
0269-SED19-6-12	BC7D1	11/12/15	1540		6–12	86	7,740	97	2.5	17, pp. 23, 25; 25, pp. 41, 54–55; 33, p. 101; 35, p. 7; 39, p. 22; 49, p. 2; 61, p. 838.
0269-SED19-12-24	BC7D0	11/12/15	1550		12–24	80.2	27,400	90.5	9	17, pp. 23, 25; 25, pp. 41, 54–55; 33, p. 96; 35, p. 7; 39, p. 21; 49, p. 2; 61, p. 794.
0269-SED07-0-6	BC793	11/12/15	1045	3.4	0–6	58.1	35,200	72.5	27	17, pp. 22, 24; 25, pp. 43, 48–49, 32, p. 103; 36, p. 6; 40, p. 3; 49, p. 2; 60, p. 943.
0269-SED06-0-6	BC790	11/12/15	1000	3.8	0–6	73.5	12,400	88.5	10.5	17, pp. 22, 24; 25, pp. 37, 39, 48; 32, p. 88; 36, p. 6; 38, p. 20; 49, p. 1; 60, p. 841.
0269-SED04-6-12	BC786	11/11/15	1630	2	6–12	58.9	25,500	61.2	37	17, p. 20; 25, pp. 36, 39, 47; 32, p. 66; 36, p. 6; 38, p. 16; 49, p. 1; 60, p. 736.

ft = feet.
in = inches.
TOC = total organic carbon.
mg/kg = milligrams per kilogram.

Background and Observed Release Concentrations
EPA Background and Release Sediment Samples, November 2015

TABLE 5. BACKGROUND AND RELEASE CONCENTRATIONS–BENZO(A)PYRENE																
	Maximum Background Concentration		**Release Concentrations**													
Field Sample ID	0269-SED02-0-6		0269-SED19-6-12		0269-SED19-12-24		0269-SED07-0-6		0268-SED06-0-6		0269-SED04-6-12		0269-SED14-0-6		0269-SED19-0-6	
EPA Sample No.	BC778		BC7D1		BC7D0		BC793		BC790		BC786		BC7B4		BC7C9	
Sample Date	11/11/15		11/12/15		11/12/15		11/12/15		11/12/15		11/11/15		11/13/15		11/12/15	
Depth (inches)	0–6		6–12		12–24		0–6		0–6		6–12		0–6		0–6	
	Result	RDL*	Result	RDL*	Result	RDL*	Result	RDL*	Result	RDL*	Result	RDL*	Result	RDL*	Result	RDL*
Benzo(a)pyrene	***350 U***	350	2,100	200	700	210	480	290	1,000	230	1,200	290	2,100	200	1,100	210
References	17, p. 20; 25, p. 35; 32, pp. 7–10, 29, 141; 60, p. 591.		17, p. 25; 25, p. 41; 33, pp. 7–10, 102, 155; 61, p. 838.		17, p. 25; 25, p. 41; 33, pp. 7–10, 97, 154; 61, p. 794.		17, p. 24; 25, p. 37; 32, pp. 7–10, 104, 155; 60, p. 943.		17, p. 24; 25, p. 37; 32, pp. 7–10, 89, 152; 60, p. 841.		17, p. 20; 25, p. 36; 32, pp. 7–10, 67, 148; 60, p. 736.		17, p. 31; 25, p. 56; 42, pp. 6–10, 32, 145; 55, p. 538.		17, p. 25; 25, p. 41; 33, pp. 7–10, 92, 153; 61, p. 747.	

Benzo(a)pyrene concentrations reported in micrograms per kilogram (µg/kg).
RDL = Reporting Detection Limit.
U = The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted Contract Required Quantitation Limit (CRQL) (i.e., SQL) for sample and method.
*The RDL for each result is the CRQL adjusted for sample and method [Ref. 30, p. 8]. Since the samples were analyzed through the CLP, these adjusted CRQLs are used in place of the HRS-defined sample quantitation limit SQL [Ref. 1, Sections 1.1 and 2.3].

Notes on samples

- Release sample concentrations are compared to the maximum background concentration, or the detection limit if the concentration of the sample was below analytical detection levels.
- Sampling Methods: The background and release samples were all collected from the tidal creek main channel by EPA, using an EPA SOP, during the same sample event in November 2015 [**Figure 2**; Ref. 17, pp. 19–21, 24–25; 25, pp. 4, 35–37, 41; 29, pp. 16, 22–23].
- Analytical Procedures: The background and release samples were all analyzed for Organic TAL SVOCs via EPA SOW SOM02.2 by the same laboratory (Chemtech Consulting Group of Mountainside, New Jersey) [Ref. 17, pp. 18, 21, 25; 25, pp. 1–3, 35–37, 41, 56, 69, 71; 55, pp. 1, 538; 60, pp. 1, 591, 736, 841, 943; 61, pp. 1, 747, 794, 838]. The chemical analyses were coordinated through the EPA CLP; EPA validated the data according to EPA Region 2 data validation guidelines (SDGs: BC775, BC794, and BC7A7) [Ref. 32, pp. 1–10; 33, pp. 1–10; 42, pp. 1–10; 55, p. 1; 60, p. 1; 61, p. 1].
- Sample Description: TOC and Grain Size analyses show that the background sediment sample contains a greater concentration of TOC than most of the release samples and a higher percentage of fine-grained material (i.e., clay and silt) than all of the release samples [see **Table 4**]. Therefore, the background sample has a greater affinity for contaminants such as benzo(a)pyrene than most of the release samples [Ref. 43, p. 11].

Attribution

While many possible sources of mercury and benzo(a)pyrene exist in the Wappinger Creek watershed upstream of the contaminated sediments, it is not possible to attribute the increase in concentration of these substances to any particular historic operation or release because of the large number of historic activities at the industrial park and in the surrounding watershed. As discussed below, there are many different types of operations that may have released these substances at the industrial park, but sampling failed to demonstrate attribution of the increase in contaminant levels to any specific source.

Sediments in the tidal portion of Wappinger Creek are contaminated with mercury and benzo(a)pyrene; the zone of contamination extends for a length of approximately 1.2 miles [**Figure 2**]. Benzo(a)pyrene is a PAH, which are a group of more than 100 different chemicals that are formed during the incomplete burning of coal, oil, gas, garbage, or other organic substances [Ref. 22, pp. 1-2]. A few PAH compounds are used in making dyes [Ref. 22, p. 1]. As discussed below, there are a number of possible sources of mercury and benzo(a)pyrene at the site.

Industrial Park

EPA investigated the industrial park area in an attempt to identify a facility at the park to which the mercury and benzo(a)pyrene releases could be attributed. While it is probable that at least part of the contamination came from this area, it was not possible to identify any single facility at the park from which the contamination originated. Industrial activities have been conducted at the industrial park location for more than 180 years [Ref. 9, p. 3]. Past uses of the location have included textile dyeing, Manufactured Gas Plant (MGP) operations, metal plating, plastic mold injection, felt hat manufacturing, ammunition production, chemical manufacturing and distribution, and several other industrial and commercial activities including a metal plating facility, the Three Star Facility [Ref. 7, pp. 9, 14–15; 9, p. 3]. Buildings within the industrial park associated with the metal plating facility had floor drains and sanitary facilities that discharged to Wappinger Creek [Ref. 7, p. 14]. A former raceway and lagoon received industrial wastes from the southern portion of the industrial park [Ref. 7, p. 19]. The “north lagoon”, which covered approximately 0.2 acre on the northern portion, reportedly received wastes from a paint manufacturing facility in the 1960s [Ref. 6, p. 65]. NYSDEC reported that the lagoon is visible on a 1995 aerial photograph and is located adjacent to Wappinger Creek [Ref. 6, p. 65]. The 1995 aerial photograph obtained by EPA shows a dark area that, based on the NYSDEC description, appears to be the north lagoon adjacent to the north bank of Wappinger Creek [Ref. 13, p. 6].

Some areas of the industrial park itself are reported to consist of variable fill materials, including coal cinders from MGP activities that occurred on the southern portion of the industrial park [Ref. 7, pp. 15, 203]. MGPs produced fuel by heating coal and then collecting and purifying the released volatiles [Ref. 21, p. 3]. The remaining solid portion of the coal (i.e., coke) was also used for industrial fuel [Ref. 21, p. 3]. The production of manufactured gas generated a dense, oily liquid waste known as coal tar [Ref. 21, p. 4]. Although most of the coal tar was collected for sale and reuse, recovery was incomplete [Ref. 21, p. 4]. Most plants had tar/water separators, which sometimes could not fully separate the two phases [Ref. 21, p. 4]. The resulting tar/water mixture was often discharged to a nearby surface water body [Ref. 21, p. 4]. It was common for substantial amounts of tar to have leaked from storage and processing facilities contaminating soils and ground water [Ref. 21, p. 4]. The MGP operated at the industrial park for approximately 38 years [Ref. 7, p. 15]. Benzo(a)pyrene was detected at a concentration of 2,100 µg/kg at EPA sediment sample location 0269-SED19 (6–12 inches), which was located adjacent to the former MGP area [Ref. 25, p. 19; 33, p. 102].

A May 2004 fire at the Three Star facility also likely contributed to PAH contamination of the surrounding area [Ref. 7, p. 16; 22, p. 1; 26, p. 2]. PAHs, including benzo(a)pyrene, can be found in exhaust from automobiles and trucks, and asphalt roads, and therefore can be ubiquitous to urban and industrial areas [Ref 26, pp. 1–2]. Gas stations and automobile repair facilities (i.e., facilities where petroleum or petroleum products are used), which are known to exist in Wappingers Falls, are also possible sources of PAHs [Ref. 10, p. 4; 26, p. 3].

Several possible sources of mercury are documented to have existed at the industrial park such as dye manufacture, felt hat manufacture, plastic mold injection, paint manufacturing, electronics reconditioning, and chlorine production [Ref. 7, pp. 9, 14–16; 9, p. 25; 15, p. 8]. Mercury (II) nitrate has historically been used in felt hat production [Ref. 20, p. 1]. Mercury can also be released to the environment from the burning of coal, as well as from some methods to produce chlorine [Ref. 23, p. 2].

To evaluate the contribution from the industrial park to the contamination at the site EPA collected surface and subsurface soil samples from nine boreholes advanced throughout northern portions (i.e., north of Wappinger Creek and north of Three Star) of the industrial park using direct-push method in October 2015 [Ref. 25, pp. 17, 19]. Sampling and analysis of soil samples collected by EPA in October 2015 at the industrial park reported the presence of PAHs at multiple locations throughout northern portions of the industrial park, and did not identify a pattern that indicated any particular facility at the park was the source of all the contamination in the contaminated sediments. PAHs were reported in boreholes 0269-S03 (depth: 1–2 feet) and 0269-S04 (depth: 1–2 feet), which were advanced in the area of the former north lagoon; 0269-S05 (depth: 1–2 feet), which was advanced in the northeastern portion of the industrial park, north of Wappinger Creek; and 0269-S07, which was also advanced near the south bank of Wappinger Creek [Ref. 17, pp. 9–11; 18, pp. 24, 31, 36, 41; 25, pp. 7–8, 17, 23–24; 59, pp. 548, 572, 600, 623]. Based on this sampling, no particular location or facility could be identified as the main source of mercury or benzo(a)pyrene at the industrial park.

The focus of NYSDEC remedial activity at the industrial park has been the former Three Star Anodizing facility, which includes several buildings in the center of the southern portion of the industrial park that housed the former Three Star metal plating facility, as well as the raceway, lagoon, MGP, and the former Axton Cross chemical manufacturing facility [Ref. 7, pp. 9–11, 52–62; 15, pp. 12–13, 65]. NYSDEC identified the former Three Star plating vats as another possible source of contamination [Ref. 7, pp. 9, 54]. Wastewater from Three Star was discharged to Wappinger Creek, either directly or via the raceway and lagoon [Ref. 7, pp. 15–16, 19]. Soil and ground water sampling indicated that surface soil, subsurface soil, and ground water beneath the Three Star Anodizing facility were contaminated with PAHs; inorganic constituents, including mercury, lead, and chromium; and chlorinated VOCs [Ref. 7, pp. 42, 44–47, 50–51].

Inorganic analysis of a surface soil sample (SS01; depth 0–24 inches) collected by NYSDEC from the raceway reported the presence of chromium (6,260 mg/kg), lead (1,100 mg/kg), arsenic (9.6 mg/kg), and zinc (558 mg/kg) [Ref. 7, pp. 80, 107]. Inorganic analysis of sediment samples collected by NYSDEC from the metal plating facility lagoon, which received wastewater from the raceway, reported the presence of (max concentrations) mercury (54 mg/kg), chromium (26,300 mg/kg), lead (9,650 mg/kg), arsenic (141 mg/kg), and zinc (3,710 mg/kg) [Ref. 7, pp. 51,

165–166]. Mercury (31 mg/kg) was also reported in a surface soil sample (SS-10; depth: 12–14 inches) collected from the former chemical manufacturing facility (i.e., Axton Cross) that was located adjacent to the lagoon [Ref. 7, pp. 80, 107, 204]. Maximum background concentrations detected in surface soil samples collected from areas outside the industrial park reported mercury, chromium, lead, arsenic, and zinc concentrations of 0.81 mg/kg, 22 mg/kg, 497 mg/kg, 22 mg/kg, and 525 mg/kg, respectively [Ref. 7, pp. 79, 88–90]. During the 2001/2003 sediment investigation, NYSDEC collected sediment samples upstream of the tidal creek from Wappinger Lake [Ref. 6, p. 76]. Maximum reported upstream concentrations of mercury were 0.57 (J-) mg/kg adjusted to 1.04 mg/kg (NYSDEC Sample ID No.: WP-LK2; 0–6 inches), non-detect (NYSDEC Sample ID Nos. WP-LK01-A, WP-LK01-B, WP-LK01-B DUP, and WP-LK01-C; 6–12 inches), 0.2 J mg/kg (NYSDEC Sample ID No. WP-LK01-A; 19–25 inches), and 0.21 J mg/kg (NYSDEC Sample ID No. WP-LK01-B; 25–31 inches) [Ref 6, pp. 276–277]. Maximum reported mercury concentrations for sediment samples collected within the tidal creek were 31.9 mg/kg (NYSDEC Sample ID No. WP-29; 0–6 inches), 186 mg/kg (NYSDEC Sample ID No. WP-DOT; 6–12 inches), and 118 mg/kg (NYSDEC Sample ID No. WP-29; 12–18 inches) [Ref.6, pp. 32, 280–281]. NYSDEC sediment sampling results show that mercury concentrations peaked at the shoal and embayment areas, then generally decreased moving downstream towards the confluence with the Hudson River [Ref. 6, p. 32]. Maximum reported mercury concentrations for sediment samples collected from three locations near the confluence with the Hudson River (NYSDEC Sample Locations WP-OD1, WP-T3A, and WP-T3B) were 8.3 J mg/kg (NYSDEC Sample ID No. WP-OD1; 0–6 inches), 20 mg/kg (NYSDEC Sample ID No. WP-OD1; 6–12 inches), and 13 mg/kg (NYSDEC Sample ID No. WP-T3A; 12–24 inches) [Ref. 6, pp. 32, 286–287].

Areas Upstream or Surrounding the Industrial Park

Activities within the Village of Wappingers Falls also represent additional possible sources of contaminants. Storm water from the Village of Wappingers Falls formerly drained to the south lagoon via a pipe that ran along the raceway, and, therefore, may have contributed to the hazardous substances identified at the site [Ref. 7, p. 19]. The Village borders the industrial park to the east and south on top of a steep embankment [Ref. 7, p. 202]. The types of industries located at a higher elevation than the industrial park include dry cleaning, machine shop, Wappingers Falls Village Landfill [CERCLA–No Further Remedial Action Planned (NFRAP)], gas stations, and automobile repair [Ref. 10, p. 4]. A Wappingers Falls Department of Public Works (DPW) (i.e., Highway Department) facility is located south of the industrial park on Lower Market Street on the eastern bank of Wappinger Creek [Ref. 6, p. 66; 68, pp. 1–2].

As part of the November 2015 sediment sampling, EPA collected sediment samples from four upstream locations (0269-SED15, 0269-SED16, 0269-SED17, and 0269-SED18) above Wappingers Falls, from Wappinger Lake and from Wappinger Creek upstream of the lake [**Figure 2**; Ref. 17, pp. 32–34, 36–37, 63–67; 25, pp. 5, 11–12]. Mercury concentrations ranged from 0.0066 J mg/kg in sediment sample 0269-SED18-12-24 (depth: 12–24 inches) to 0.11 J mg/kg in sediment sample 0269-SED15-12-24 (depth: 12–24 inches) [Ref. 52, pp. 19–20, 29, 34, 37, 39, 41, 43, 45, 47, 49–50; 65, pp. 450–461]. Sample analyses reported non-detect values for benzo(a)pyrene for all upstream sediment samples [**Figure 2**; Ref. 42, pp. 44, 47, 52, 57, 62, 69, 74, 79, 84, 89, 92, 97; 55, pp. 685, 699, 712, 725, 738, 751, 764, 779, 797, 824, 844, 858]. Although these samples were not used to characterize background in the observed release evaluation, they do provide documentation that potential upstream sources are not contributing to the increase in mercury and benzo(a)pyrene concentrations detected in the tidal creek.

EPA also sampled south of the industrial park to determine if contamination was entering the creek from that area. Analysis of soil samples collected from borehole 0269-S10 south of the industrial park contained non-detect levels of PAHs, with a maximum adjusted CRQL of 200 U mg/kg reported for soil samples 0269-S10 and 0269-SS10B [Ref 17, pp. 12–13; 19, pp. 2, 25, 48; 25, pp. 17, 26; 57, pp. 471, 553].

Possible Tidal Sources

EPA collected sediment samples from locations 0269-SED01 and 0269-SED02 to account for possible contaminants contributions from the Hudson River [**Figures 2 and 3**]. Sediment sample locations 0269-SED01 and 0269-SED02 were located within Wappinger Creek, downstream of the zone of actual contamination and just upstream of the confluence of Wappinger Creek and the Hudson River [**Figures 2 and 3**]. Sample analytical results report mercury

and benzo(a)pyrene concentrations that are significantly higher in the release samples used to define the zone of contamination than those reported for the background samples [**Tables 3 and 5**; **Figure 2**; Ref. 32, pp. 13, 19, 24, 29, 32, 39, 67, 104, 89, 107; 33, pp. 92, 97, 102; 42, p. 32; 48, pp. 10, 27, 39, 46]. Based on these results, it is unlikely that the significant increase in mercury and benzo(a)pyrene concentrations are due to tidal carry form the Hudson River and any other possible downstream sources.

Embayment Samples

As part of the November 2015 sediment sampling, EPA also collected sediment samples from two locations within the embayment along the north bank of Wappinger Creek, downstream of the industrial park (0269-SED08 and 0269-SED09) [**Figure 2**; Ref. 17, pp. 23–24]. Background samples from a similar quiescent environment could not be obtained; therefore, these samples cannot be used to establish an observed release. However, analytical results identified the presence of mercury in the sediment located in the embayment. The reported mercury concentrations for sediment samples collected from 0269-SED08 were 35.5 J mg/kg (0–6 inches) and 109 J mg/kg (6–12 inches) [Ref. 50, pp. 23, 27; 62, pp. 494, 496]. The reported mercury concentrations for sediment samples collected from 0269-SED09 were 48.7 J mg/kg (6–12 inches) and 25.6 J (12–24 inches) [Ref. 50, pp. 37, 39; 62, pp. 498–499]. NYSDEC considers sediment to be contaminated with mercury at concentrations greater than 1 mg/kg to be highly contaminated and likely pose a risk to aquatic life [Ref. 46, p. 11].

Hazardous Substances Released:

Mercury
Benzo(a)pyrene

==========

Observed Release Factor Value: 550

4.1.3.2 Human Food Chain Threat - Waste Characteristics

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

TABLE 6. TOXICITY/PERSISTENCE/BIOACCUMULATION						
Hazardous Substance	**Source Number**	**Toxicity Factor Value**	**River Persistence Factor Value**	**Fresh Water Food Chain Bioaccumulation Factor Value**	**Toxicity/Persistence/ Bioaccumulation Factor Value (HRS Table 4-16)**	**Ref. 2 Page**
Mercury	1	10,000	1	50,000	5×10^8	4
Benzo(a)pyrene	1	10,000	1	50,000	5×10^8	1

4.1.3.2.2 Hazardous Waste Quantity

TABLE 7. HAZARDOUS WASTE QUANTITY		
Source Number	**Source Hazardous Waste Quantity (HWQ) Value (HRS Section 2.4.2.1.5)**	**Is source hazardous constituent quantity data complete? (yes/no)**
1	>0 (exact amount unknown)	No
Sum of Values:	>0	

The sum of hazardous waste quantity values corresponds to a hazardous waste quantity factor value of 1 in HRS Table 2-6 [Ref. 1, Section 2.4.2.2]. However, the HRS states that if any target is subject to Level I or Level II concentrations, assign either the value for Table 2-6 or a value of 100, whichever is greater, as the hazardous waste quantity factor value for that pathway [Ref. 1, Section 2.4.2.2]. Therefore, a hazardous waste quantity factor value of 100 is assigned for the surface water migration pathway.

4.1.3.2.3 Waste Characteristics Factor Category Value

Mercury and benzo(a)pyrene associated with Source 1, which has a surface water pathway containment factor value greater than 0 for the watershed, correspond to a toxicity/persistence factor value of 10,000 and bioaccumulation potential factor value of 50,000, as shown above [Ref. 1, Section 4.1.3.2.1.4; 2, pp. 1, 4].

(Toxicity/Persistence Factor Value) x (Hazardous Waste Quantity Factor Value) =
$10{,}000 \times 100 = 1 \times 10^6$
(Subject to a maximum of 1×10^8)
[Ref. 1, Section 4.1.3.2.3]

(Toxicity/Persistence Factor Value x Hazardous Waste Quantity Factor Value) x
(Bioaccumulation Potential Factor Value) = $(1 \times 10^6) \times (50{,}000) = 5 \times 10^{10}$
(Subject to a maximum of 1×10^{12})
[Ref. 1, Section 4.1.3.2.3]

The resulting waste characteristics product of 5×10^{10} corresponds to a Waste Characteristics Factor Category of Value of 320 in Table 2-7 of the HRS [Ref. 1, Section 2.4.3.1].

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Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8
Hazardous Waste Quantity Factor Value: 100
Waste Characteristics Factor Category Value: 320

4.1.3.3 Human Food Chain Threat - Targets

Wappinger Creek is used for consumption fishing [Ref. 3, p. 6; 16, p. 3; 17, p. 20]. Access to the creek for fishing is within the industrial park (on the west bridge, which connects the northern and southern portions and the upstream side of the southern bank across from the hydroelectric plant) and along most of the western shoreline of the tidal creek via the Wappinger Greenway Trail [**Figure 2**; Ref. 3, pp. 6, 10; 14, p. 2]. On June 3, 2015, EPA personnel observed a local resident fishing within the industrial park [Ref. 3, p. 6; 16, p. 3]. The resident stated that he consumes approximately 40 percent of the fish he catches in Wappinger Creek, including herring and striped bass [Ref 16, p. 3]. Additional public access on the eastern shoreline is provided by a public boat launch located on Creek Road, approximately 0.5 mile downstream of the industrial park [**Figure 2**; Ref. 3, p. 12; 16, p. 2]. In October 2015, EPA observed a recreational fishing boat in the tidal creek [Ref. 17, pp. 4–5]. The occupants stated that most fishing in the tidal creek occurs during warm weather [Ref. 17, p. 5]. On November 11, 2015, a local resident stated to EPA that fishing for consumption occurs throughout the tidal creek and the species commonly consumed include crabs and carp [Ref. 17, p. 20]. The available documentation demonstrates that fishing for human consumption occurs throughout the tidal creek and the zone of contamination as currently defined by EPA sediment sample results is located within the fishery; therefore, the target fishery is evaluated for Level II actual contamination [**Figure 2**; Ref. 1, Section 4.1.3.3].

Samples for Observed Release/Potential Concentrations

The sediment concentrations meet the criteria for Level II concentrations because they meet the criteria for observed release and their locations are associated with a human food chain fishery [Ref. 1, Section 2.5 and 4.1.4.3.1.2]:

TABLE 8. SEDIMENT SAMPLES FOR OBSERVED RELEASE

Sample ID	Depth (inches)	Hazardous Substance	Concentration
0269-SED14-0-6	0–6	Benzo(a)pyrene	2,100 µg/kg
0269-SED19-0-6	0–6	Benzo(a)pyrene	1,100 µg/kg
0269-SED19-6-12	6-12	Benzo(a)pyrene	2,100 µg/kg
0269-SED19-12-24	12–24	Benzo(a)pyrene	700 µg/kg
0269-SED7-0-6	0–6	Benzo(a)pyrene	480 µg/kg
0269-SED06-0-6	0–6	Benzo(a)pyrene	1,000 µg/kg
0269-SED04-6-12	6–12	Benzo(a)pyrene	1,200 µg/kg
0269-SED04-6-12	6–12	Mercury	16.7 mg/kg
0269-SED06-0-6	12–24	Mercury	3.5 mg/kg

[Ref. 32, pp. 67, 89, 104; 33, pp 92, 97, 102; 42, p. 32; 48, pp. 39, 46; 55, p. 538; 60, pp. 736, 841, 943; 61, pp. 747, 794, 838; 64, pp. 598, 602]

4.1.3.3.1 Food Chain Individual

There is an observed release to surface water of two hazardous substances (mercury and benzo[a]pyrene) with a bioaccumulation potential factor value of 500 or greater in several samples identified below, and there is Level II actual contamination of a fishery [see **Sections 4.1.2.1.1**, **4.1.3.2.1.3**, and **4.1.3.3** of this HRS documentation record]. Therefore, a food chain individual factor value of 45 is assigned [Ref. 1, Section 4.1.3.3.1].

Sample IDs:	0269-SED06-0-6, 0269-SED04-6-12
Hazardous Substance:	Mercury
Bioaccumulation Potential:	50,000
References:	See **Section 4.1.2.1.1**of this HRS documentation record.

Sample IDs:	0269-SED19-0-6, 0269-SED19-6-12, 0269-SED19-12-24, 0269-SED07-0-6, 0269-SED06-0-6, 0269-SED04-6-12, 0269-SED14-0-6
Hazardous Substance:	Benzo(a)pyrene
Bioaccumulation Potential:	50,000
References:	See **Section 4.1.2.1.1**of this HRS documentation record.

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Food Chain Individual Factor Value: 45

4.1.3.3.2 Population

4.1.3.3.2.1 Level I Concentrations

The Level I concentrations factor value is 0 because there are no fisheries subject to Level I concentrations [Ref. 1, Section 4.1.3.3.2.1].

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Level I Concentrations Factor Value: 0

4.1.3.3.2.2 Level II Concentrations

Wappinger Creek is used for consumption fishing [Ref. 3, p. 6; 16, p. 3; 17, p. 20]. Access to the creek for fishing is within the industrial park (on the west bridge, which connects the northern and southern portions and on the upstream side of the southern bank across from the hydroelectric plant) and along most of the western shoreline of the tidal creek via the Wappinger Greenway Trail [**Figure 2**; Ref. 3, pp. 6, 10; 14, p. 2]. On June 3, 2015, EPA personnel observed a local resident fishing within the industrial park [Ref. 3, p. 6; 16, p. 3]. The resident stated that he consumes approximately 40 percent of the fish he catches in Wappinger Creek, including herring and striped bass [Ref 16, p. 3]. Additional public access on the eastern shoreline is provided by a public boat launch located on Creek Road, approximately 0.5 mile south of the industrial park [**Figure 2**; Ref. 3, p. 12; 16, p. 2]. On November 11, 2015, a local resident stated to EPA that the entire tidal creek is used for consumption fishing [Ref. 17, p. 20]. The species commonly consumed include crab and carp [Ref. 17, p. 20]. The fish consumption rate for the downstream fishery is not documented, so the fishery is assigned to the category "Greater than 0 to 100 pounds per year," which corresponds to the assigned human food chain population value of 0.03 in Table 4-18 of the HRS [Ref. 1, Section 4.1.3.3.2]. The available documentation demonstrates that fishing for human consumption occurs throughout the tidal creek and the zone of contamination as currently defined by EPA sediment sample results is located within the fishery; therefore, the target fishery is evaluated for Level II actual contamination [**Figure 2**; Ref. 1, Section 4.1.3.3].

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Level II Concentrations Factor Value: 0.03

4.1.3.3.2.3 Potential Human Food Chain Contamination

The potential human food chain contamination value is 0 because there are no documented fisheries subject to potential concentrations [Ref. 1, Section 4.1.3.3.2.3].

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Potential Human Food Chain Contamination Factor Value: 0

4.1.4.2 Environmental Threat - Waste Characteristics

4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation

TABLE 9. ECOTOXICITY/PERSISTENCE/BIOACCUMULATION						
Hazardous Substance	**Source Number**	**Fresh Water Ecotoxicity Factor Value**	**River Persistence Factor Value**	**Fresh Water Ecosystem Bioaccumulation Factor Value**	**Ecotoxicity/Persistence/ Bioaccumulation Factor Value (HRS Table 4-21)**	**Ref. 2 Page**
Mercury	1	10,000	1	50,000	5×10^8	4
Benzo(a)pyrene	1	10,000	1	50,000	5×10^8	1

4.1.4.2.2 Hazardous Waste Quantity

TABLE 10. HAZARDOUS WASTE QUANTITY		
Source Number	**Source Hazardous Waste Quantity (HWQ) Value (HRS Section 2.4.2.1.5)**	**Is source hazardous constituent quantity data complete? (yes/no)**
1	>0 (exact amount unknown)	No
Sum of Values:	>0	

The sum of hazardous waste quantity values corresponds to a hazardous waste quantity factor value of 1 in HRS Table 2-6 [Ref. 1, Section 2.4.2.2]. However, the HRS states that if any target is subject to Level I or Level II concentrations, assign either the value for Table 2-6 or a value of 100, whichever is greater, as the hazardous waste quantity factor value for that pathway [Ref. 1, Section 2.4.2.2]. Therefore, a hazardous waste quantity factor value of 100 is assigned for the surface water migration pathway.

4.1.4.2.3 Waste Characteristics Factor Category Value

Mercury and benzo(a)pyrene associated with Source 1, which has a surface water pathway containment factor value greater than 0 for the watershed, correspond to an ecotoxicity/persistence factor value of 10,000 and bioaccumulation potential factor value of 50,000, as shown above [Ref. 1, Section 4.1.4.2.1.4; 2, pp. 1, 4].

(Ecotoxicity/persistence factor value) x (hazardous waste quantity factor value) =
$10{,}000 \times 100 = 1 \times 10^6$
(Subject to a maximum of 1×10^8)
[Ref. 1, Section 4.1.4.2.3]

(Ecotoxicity/persistence factor value x hazardous waste quantity factor value) x
(bioaccumulation potential factor value) = $(1 \times 10^6) \times (50{,}000) = 5 \times 10^{10}$
(Subject to a maximum of 1×10^{12})
[Ref. 1, Section 4.1.4.2.3]

The resulting waste characteristics product of 5×10^{10} corresponds to a waste characteristics factor category value of 320 in Table 2-7 of the HRS [Ref. 1, Section 2.4.3.1].

Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8
Hazardous Waste Quantity Factor Value: 100
Waste Characteristics Factor Category Value: 320

4.1.4.3 Environmental Threat - Targets

The zone of contamination (i.e., the creek segment where observed release by chemical analysis is documented) along the surface water migration pathway downstream of the site source extends from sediment sample location 0269-SED14 south and downstream to sediment sample location 0269-SED04, a length of approximately 1.2 miles (6,082 feet) [**Figure 2**]. The zone of contamination includes a wetland that forms a peninsula that separates the Wappinger Creek main channel and the embayment [**Figure 2**]. The wetland is classified by the U.S. Fish and Wildlife Service as a Palustrine Freshwater Forested/Shrub Wetland (PFO1S) [Ref. 24, p. 1]. This HRS-eligible wetland is located along the hazardous substance migration path in the area of Level II concentrations, and the total wetland frontage considered as subject to actual contamination is 0.2 mile [**Figure 2**; Ref. 1, Section 4.1.4.3.1]. The contaminated sediment sample locations in Table 11 define the hazardous substance migration path [**Figure 2**]. There are no media-specific benchmarks for sediment, so the target wetland is subject to Level II concentrations [Ref. 1, Sections 2.5 and 4.1.4.3].

Samples for Observed Release/Level II Concentrations

The sediment concentrations meet the criteria for Level II concentrations because they meet criteria for observed release and their locations are associated with an eligible HRS wetland [Ref. 1, Sections 2.5 and 4.1.4.3.1; 2, pp. 2, 4]:

TABLE 11. SEDIMENT SAMPLES FOR OBSERVED RELEASE

Sample ID	Depth (inches)	Hazardous Substance	Concentration
0269-SED14-0-6	0–6	Benzo(a)pyrene	2,100 µg/kg
0269-SED19-0-6	0–6	Benzo(a)pyrene	1,100 µg/kg
0269-SED19-6-12	6-12	Benzo(a)pyrene	2,100 µg/kg
0269-SED19-12-24	12–24	Benzo(a)pyrene	700 µg/kg
0269-SED7-0-6	0–6	Benzo(a)pyrene	480 µg/kg
0269-SED06-0-6	0–6	Benzo(a)pyrene	1,000 µg/kg
0269-SED04-6-12	6–12	Benzo(a)pyrene	1,200 µg/kg
0269-SED04-6-12	6–12	Mercury	16.7 mg/kg
0269-SED06-0-6	12–24	Mercury	3.5 mg/kg

[Ref. 32, pp. 67, 89, 104; 33, pp 92, 97, 102; 42, p. 32; 48, pp. 39, 46; 55, p. 538; 60, pp. 736, 841, 943; 61, pp. 747, 794, 838; 64, pp. 598, 602]

4.1.4.3.1 Sensitive Environments

4.1.4.3.1.1 Level I Concentrations

The Level I concentrations factor value is 0 because there are no sensitive environments subject to Level I concentrations [Ref. 1, Section 4.1.4.3.1.1].

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Level I Concentrations Factor Value: 0

4.1.4.3.1.2 Level II Concentrations

The target wetlands are subject to Level II concentrations because they are located in a Level II zone of contamination delineated by samples meeting observed release criteria [**Figure 2**; Ref. 1, Sections 2.5 and 4.1.4.3].

Sensitive Environments

There are currently no known sensitive environments other than wetlands that are considered as subject to Level II concentrations [Ref. 1, Section 4.1.4.3].

Wetlands

There is an HRS-eligible wetland along the zone of contamination, and the total wetland frontage subject to actual contamination is greater than 0.1 mile [**Figure 2**; Ref. 1, Section 4.1.4.3.2; 24, p. 1].

TABLE 12. LEVEL II CONCENTRATIONS – WETLANDS

Wetland	Wetland Frontage	Wetlands Rating Value (HRS Table 4-24)	Reference
Wappinger Creek	0.2 mile	25	**Figure 2**

Wetland Value: 25

Sum of Sensitive Environments Value + Wetland Value: 25

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Level II Concentrations Factor Value: 25

4.1.4.3.1.3 Potential Contamination

The potential contamination factor value is not scored because the site already receives a listing-eligible site score based on other factors.

Sensitive Environments

The sensitive environment value (S_j) is not scored.

Wetlands

Although the most recent National Wetlands Inventory (NWI) information available from U.S. Fish and Wildlife Service (USFWS) indicates that there are approximately 1.4 miles of potentially contaminated wetland frontage within the TDL, the wetland frontage value (W_j) is not scored [**Figure 3**].

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Potential Contamination Factor Value: NS